C L A I M S

1. A node apparatus which has a VC set between at least two adjacent node apparatuses and transfers a packet over the VC, characterized by comprising

a route table, a quality description table, a plurality of output queues, and an output control section for performing read control on a packet from each output queue so as to achieve a quality set for each output queue, wherein an output destination of an incoming packet is determined by searching said route table by using header information of the packet, a quality class of the packet is determined by searching said quality description table, the packet is stored in an output queue determined by the determined output destination and quality class, and the packet is read out from said output queue in accordance with the quality set for said output queue.

2. A node apparatus according to claim 1, characterized in that said node apparatus comprises an ATM switch capable of performing quality control on each output queue, and a quality guarantee on a packet level is performed by using a cell-level quality guarantee mechanism of said ATM switch.

3. A node apparatus which has a VC set between node apparatuses and configured to transfer a packet over the VC, characterized by comprising

a route table and a quality description table, wherein an output destination of an incoming packet is determined by searching said route table by using header information of the packet, a quality class of the packet is determined by searching

said quality description table, the packet is sent out through a VC determined by the determined output destination and quality class, and a plurality of VCs with different qualities are set for the same output destination.

4. A node apparatus according to claim 1, characterized in that said quality description table has at least a virtual dedicated network number field, a destination address/mask length field, a source address/mask length field, a fourth-layer protocol/source port number field, and a destination port number field, and specific values are written in the respective fields or a blank field is formed to match any value.

5. A node apparatus according to claim 3, characterized in that said quality description table has at least a virtual dedicated network number field, a destination address/mask length field, a source address/mask length field, a fourth-layer protocol/source port number field, and a destination port number field, and specific values are written in the respective fields or a blank field is formed to match any value.

6. A node apparatus according to claim 4, characterized in that each entry of said quality description table has a priority, any entry in which all fields other than a blank field match an incoming packet is selected from said quality description table in searching said quality description table, and if a plurality of entries are selected, an entry having the highest priority is selected from the selected entries.

7. A node apparatus according to claim 5, characterized in that each entry of said quality description table has a priority, any entry in which all fields other than a blank field match an

incoming packet is selected from said quality description table in searching said quality description table, and if a plurality of entries are selected, an entry having the highest priority is selected from the selected entries.

8. A node apparatus according to claim 4, characterized in that each field of said quality description table has a priority, any entry in which all fields other than a blank field match an incoming packet is selected from said quality description table in searching said quality description table, and if a plurality of entries are selected, an entry in which a match is obtained in a field with a higher priority is selected from the selected entries.

9. A node apparatus according to claim 5, characterized in that each field of said quality description table has a priority, any entry in which all fields other than a blank field match an incoming packet is selected from said quality description table in searching said quality description table, and if a plurality of entries are selected, an entry in which a match is obtained in a field with a higher priority is selected from the selected entries.

10. A node apparatus according to claim 4, characterized in that said route table and said quality description table have entries in units of virtual dedicated networks, a virtual dedicated network to which a packet belongs is specified from a VC through which the packet has arrived, and an output queue for storing the packet or an output VC to which the packet is output is determined by using entries of said route table and quality description table for the specified virtual dedicated network.

11. A node apparatus according to claim 5, characterized in that said route table and said quality description table have entries in units of virtual dedicated networks, a virtual dedicated network to which a packet belongs is specified from a VC through which the packet has arrived, and an output queue for storing the packet or an output VC to which the packet is output is determined by using entries of said route table and quality description table for the specified virtual dedicated network.

12. A node apparatus which has a plurality of VCs with different qualities set between said node apparatus and another adjacent node apparatus and transfers a packet over the VC, characterized by comprising:

a plurality of output queues for which predetermined qualities are respectively set;

a route table in which in correspondence with a destination address, an output destination of a packet having the destination address is defined;

a quality description table in which in correspondence with predetermined information in a packet header, a quality class of the packet having the information in the packet header is defined;

an output table in which in correspondence with a pair of an output destination of a packet and a quality class, an output queue in which the packet should be stored and an output VC to which the packet in said output queue should be output are defined;

a header processing section for determining an output destination of an incoming packet by searching said route table

by using an destination address in a header of the packet, determining a quality class of the packet by searching said quality table by using the predetermined information in the header, determining an output queue in which the packet is to be stored and an output VC by searching said output table by using a pair of the determined output destination of the packet and the determined quality class, and storing the incoming packet in said determined output queue; and

an output control section for reading out a packet from each of said output queues so as to achieve a quality set for each of said output queues, and outputting the packet to the determined output VC.

13. A node apparatus which has a plurality of VCs with different qualities set between said node apparatus and another adjacent node apparatus and transfers a packet over the VC, characterized by comprising:

a plurality of output queues for which predetermined qualities are respectively set;

an output table in which in correspondence with a destination address of a packet and a predetermined type of information in a packet header, an output queue in which a packet having the destination address and the predetermined information are to be stored and an output VC to which the packet in said output queue is to be output are defined;

a header processing section for determining an output queue in which the packet is stored and an output VC by searching said output table by using the destination address and the predetermined information in a header of an incoming packet; and

an output control section for reading out a packet from each of said output queues so as to achieve a quality set for each of said output queues, and outputting the packet to the determined output VC.

(14) A node apparatus which has a plurality of VCs with different qualities set between said node apparatus and another adjacent node apparatus and transfers a packet over the VC upon segmenting the packet into cells, characterized by comprising:

a plurality of output queues for which predetermined qualities are respectively set;

a packet queue for each input VC;

a rout table in which in correspondence with a destination address, an output destination of a packet having the destination address is defined;

a quality description table in which in correspondence with predetermined information in a packet header, a quality class of the packet having the information in the packet header is defined;

an output table in which in correspondence with a pair of an output destination of a packet and a quality class, an output queue in which the packet is to be stored and an output VC to which the packet in said output queue is to be output are defined;

a header processing section for, when a start cell of a packet arrives, determining an output destination of the packet by searching said route table by using a destination address in a packet header contained in the start cell, determining a quality class of the packet by searching said quality table by

using the predetermined information in the header, determining an output queue in which the packet is stored and an output VC by searching said output table by using a pair of the determined output destination of the packet and the determined quality class, and storing the start cell in said packet queue corresponding to an input VC, and for, when a cell other than the start cell of the packet arrives, storing the incoming cell in said packet queue corresponding to an input VC, and simultaneously moving all cells constituting the packet stored in said packet queue to said determined output queue when a final cell of the packet is stored; and

an output control section for reading out a cell of a packet from each of said output queues so as to achieve a quality set for each of said output queues and outputting the cell to the determined output VC.

15. A quality guarantee node apparatus which has a plurality of VCs with different qualities set between said node apparatus and another adjacent node apparatus and transfers a packet over the VC upon segmenting the packet into cells, characterized by comprising:

a plurality of input buffer sections, a plurality of output buffer sections, and a cell step section for transferring a cell of a packet output from an arbitrary input buffer section to an arbitrary output buffer section,

a. each of said input buffer sections including

first output queues for which predetermined qualities are respectively set and which are prepared for the respective output VCs of said node apparatus,

a first packet queue for each input VC,

(5) a rout table in which in correspondence with a destination address, an output destination of a packet having the destination address is defined,

(6) a quality description table in which in correspondence with predetermined information in a packet header, a quality class of the packet having the information in the packet header is defined,

(7) an output table in which in correspondence with a pair of an output destination of a packet and a quality class, a first output queue in which the packet is to be stored and an output VC to which the packet in said first output queue is to be output are defined,

(8) a header processing section for, when a start cell of a packet arrives, determining an output destination of the packet by searching said route table by using a destination address in a packet header contained in the start cell, determining a quality class of the packet by searching said quality table by using the predetermined information in the header, determining a first output queue in which the packet is stored and an output VC by searching said output table by using a pair of the determined output destination of the packet and the determined quality class, and storing the start cell in said first packet queue corresponding to an input VC, and for, when a cell other than the start cell of the packet arrives, storing the incoming cell in said first packet queue corresponding to an input VC, and simultaneously moving all cells constituting the packet stored in said first packet queue to said determined first

output queue when a final cell of the packet is stored, and

a first output control section for reading out a cell of a packet from each of said first output queues so as to achieve a quality set for each of said first output queues, and outputting the cell to an output buffer section having the determined output VC via said cell switch section, and

b. each of said output buffer sections including

second packet queues prepared to be equal in number to said input buffer sections for the respective output VCs of said output buffer section,

a second output queue which is prepared for each output VC of said output buffer section and for which the sum of qualities set for output queues of said input buffer section which correspond to the output VC is set,

a second header processing section for, when a cell is input from said cell switch section, storing the cell in said second packet queue corresponding to said input buffer section as a source of the cell and an output VC, and simultaneously moving all cells stored in said second packet queue to said second output queue corresponding to the output VC after a final cell of the packet is stored, and

a second output control section for reading out a cell of a packet from each of said second output queues so as to achieve a quality set for each of said second output queues and outputting the cell to the determined output VC.

16. A node apparatus according to claim 14, characterized in that said node apparatus comprises an ATM switch capable of performing quality control on each output queue, and a quality

guarantee on a packet level is performed by using a cell-level quality guarantee mechanism of said ATM switch.

17. A node apparatus according to claim 15, characterized in that said node apparatus comprises an ATM switch capable of performing quality control on each output queue, and a quality guarantee on a packet level is performed by using a cell-level quality guarantee mechanism of said ATM switch.

18. A node apparatus according to claim 12, characterized in that said quality description table has at least a virtual dedicated network number field, a destination address/mask length field, a source address/mask length field, a fourth-layer protocol/source port number field, and a destination port number field, and specific values are written in the respective fields or a blank field is formed to match any value.

19. A node apparatus according to claim 14, characterized in that said quality description table has at least a virtual dedicated network number field, a destination address/mask length field, a source address/mask length field, a fourth-layer protocol/source port number field, and a destination port number field, and specific values are written in the respective fields or a blank field is formed to match any value.

20. A node apparatus according to claim 15, characterized in that said quality description table has at least a virtual dedicated network number field, a destination address/mask length field, a source address/mask length field, a fourth-layer protocol/source port number field, and a destination port number field, and specific values are written in the respective fields or a blank field is formed to match any value.

21. A node apparatus according to claim 18, characterized in that each entry of said quality description table has a priority, any entry in which all fields other than a blank field match an incoming packet is selected from said quality description table in searching said quality description table, and if a plurality of entries are selected, an entry having the highest priority is selected from the selected entries.

22. A node apparatus according to claim 19, characterized in that each entry of said quality description table has a priority, any entry in which all fields other than a blank field match an incoming packet is selected from said quality description table in searching said quality description table, and if a plurality of entries are selected, an entry having the highest priority is selected from the selected entries.

23. A node apparatus according to claim 20, characterized in that each entry of said quality description table has a priority, any entry in which all fields other than a blank field match an incoming packet is selected from said quality description table in searching said quality description table, and if a plurality of entries are selected, an entry having the highest priority is selected from the selected entries.

24. A node apparatus according to claim 18, characterized in that each field of said quality description table has a priority, any entry in which all fields other than a blank field match an incoming packet is selected from said quality description table in searching said quality description table, and if a plurality of entries are selected, an entry in which a match is obtained in a field with a higher priority is selected from the selected

entries.

25. A node apparatus according to claim 19, characterized in that each field of said quality description table has a priority, any entry in which all fields other than a blank field match an incoming packet is selected from said quality description table in searching said quality description table, and if a plurality of entries are selected, an entry in which a match is obtained in a field with a higher priority is selected from the selected entries.

26. A node apparatus according to claim 20, characterized in that each field of said quality description table has a priority, any entry in which all fields other than a blank field match an incoming packet is selected from said quality description table in searching said quality description table, and if a plurality of entries are selected, an entry in which a match is obtained in a field with a higher priority is selected from the selected entries.

27. A node apparatus which performs switching for a packet segmented into cells according to AAL5 without reassembling the cells into the packet, characterized by comprising packet queues prepared in units of input VCs, output queues prepared in units of output VCs, an IP route table in which route information is written for each destination IP address, an IP processing section for sequentially storing cells constituting a packet arriving from each input VC in said packet queue corresponding to each input VC, and simultaneously moving all cells in said packet queue in which cells corresponding to one packet are stored to said output queue corresponding to route information

described in said IP route table in correspondence with a destination IP address contained in a start cell, and an output section for outputting the cells in said output queue to a corresponding output VC.

28. A node apparatus according to claim 27, characterized in that a CRC check on an AAL5 frame and a CRC re-calculation accompanying IP header updating are performed while the AAL5 frame is segmented into cells without packet reassembly.

29. A node apparatus according to claim 28, characterized in that said node apparatus comprises a VC table for storing an interim value for a CRC check on an AAL5 frame and an interim value for a CRC re-calculation, and said IP processing section is configured to calculate, when a start cell of a packet arrives, a CRC value from the incoming cell, store an interim value in said VC table, re-calculate a CRC value from the start cell upon IP header updating, store an interim value in said VC table, calculate, when a cell other than the start cell of the packet arrives, a new CRC value from the incoming cell and the interim value for a CRC check, stored in said VC table, store the interim value in said VC table, calculate a new CRC value from the incoming cell and the interim value for a CRC re-calculation, stored in said VC table, store the interim value in said VC table, and write, after a CRC value is calculated from a final cell of the packet, a re-calculated CRC value in a CRC field of the final cell, and also check a CRC error in the AAL5 frame from a calculated value for a CRC check.

30. A node apparatus according to claim 27, characterized in that not only a cell of a packet but also a general ATM cell are

processed.

31. A node apparatus according to claim 30, characterized by comprising a VC table containing an IP identification flag for designating each input VC as an input VC set for ATM or IP and an output destination queue for designating an output queue when an input VC is set for ATM, and a header processing section for storing, at the time of arrival of a cell, the cell which has arrived through an input VC set for ATM in an output destination queue designated by the output destination queue in said VC table in correspondence with the input VC through which the cell has arrived, and transferring the cell which has arrived through an input VC set for IP to said IP processing section.

32. A node apparatus according to claim 30, characterized in that when an incoming packet is a multicast packet, said IP processing section implements an IP multicast function by using a cell multicast function of an ATM switch instead of copying the packet.

33. A node apparatus according to claim 31, characterized in that when an incoming packet is a multicast packet, said IP processing section implements an IP multicast function by using a cell multicast function of an ATM switch instead of copying the packet.

34. A node apparatus according to claim 27, characterized in that said node apparatus comprises an IP server section having necessary functions as an IP router, e.g., a function of processing a routing packet and a function of processing a packet with an IP option, and a function of managing said IP route table, and when an incoming packet cannot be processed by

said IP processing section, transfers the packet to said IP server section to make said IP server section process the packet and update said IP route table if required as a result of processing.

35. A node apparatus according to claim 34, characterized in that said IP route table holds a substantially perfect copy of part of an IP route table held in said IP server section, and when a route search with respect to a given packet fails in said IP processing section, the packet is transferred to said IP server section to make said IP server section process the packet and update said IP route table which has failed the route search.

36. A node apparatus according to claim 34, characterized in that said IP route table holds a substantially perfect copy of part of an IP route table held in said IP server section, and when a route search with respect to a given packet fails in said IP processing section, said IP server section is requested to perform a route search with respect to the packet, said IP server section performs a route search in accordance with the request and notifies said IP processing section of the result, and said IP processing section processes the packet in accordance with the route search result.

37. A node apparatus according to claim 27, characterized in that different VCs are set between said node apparatus and another node apparatus in units of virtual dedicated networks, route information for each virtual dedicated network is defined in said IP route table, a virtual dedicated network is specified from an input VC through which a cell has arrived, and route information of the packet is obtained by searching said IP route

table by using the specified virtual dedicated network and a destination IP address.

38. A node apparatus according to claim 28, characterized in that different VCs are set between said node apparatus and another node apparatus in units of virtual dedicated networks, route information for each virtual dedicated network is defined in said IP route table, a virtual dedicated network is specified from an input VC through which a cell has arrived, and route information of the packet is obtained by searching said IP route table by using the specified virtual dedicated network and a destination IP address.

39. A node apparatus according to claim 27, characterized in that said node apparatus has different IP addresses in units of virtual dedicated networks, and generates IP route information by executing different IP routing protocols in units of virtual dedicated networks.

40. A node apparatus according to claim 28, characterized in that said node apparatus has different IP addresses in units of virtual dedicated networks, and generates IP route information by executing different IP routing protocols in units of virtual dedicated networks.

41. A node apparatus which comprises a plurality of input buffer sections, a plurality of output buffer sections, and a cell switch section for transferring a cell output from an arbitrary input buffer section to an arbitrary output buffer section, and performs switching for a packet segmented into cells according to AAL5 without packet reassembly,

characterized in that each of said input buffer sections

comprises a first packet queue for each input VC of said input buffer section, a first output queue for each output VC in said node apparatus, an IP route table in which route information is described for each destination IP address, a first IP processing section for sequentially storing cells constituting a packet arriving from each input VC in said first packet queue corresponding to each input VC, and simultaneously moving all cells in said first packet queue in which cells corresponding to one packet are stored to a first output queue corresponding to route information described in said IP route table in correspondence with a destination IP address contained in a start cell, and a first output section for outputting a cell in said first output queue to a corresponding output buffer section through said cell switch section upon converting a VPI/VCI in the cell into an internal identifier which can uniquely identify an output VC and self-input buffer section, and

each of said output buffer sections comprises second packet queues prepared to be equal in number to said input buffer sections for the respective output VCs of said output buffer section, a second output queue for each output VC of said output buffer section, a second IP processing section for sequentially storing cells arriving from each input buffer section through said cell switch section in said second packet queue corresponding to an internal identifier in each cell, and simultaneously moving all cells in said second packet queue in which cells corresponding to one packet are stored to said second output queue corresponding to the internal identifier contained in each cell, and a second output section for

outputting a cell in said second output queue to a corresponding output VC upon converting the internal identifier in the cell into an output VPI/VCI.

(42.) A node apparatus which comprises a plurality of input buffer sections, a plurality of output buffer sections, and a cell switch section for transferring a cell output from an arbitrary input buffer section to an arbitrary output buffer section, and performs switching for a packet segmented into cells according to AAL5 without packet reassembly,

characterized in that each of said input buffer sections comprises a first packet queue for each input VC of said input buffer section, a first output queue for each output VC in said node apparatus, an IP route table in which route information is described for each destination IP address, a first IP processing section for sequentially storing cells constituting a packet arriving from each input VC in said first packet queue corresponding to each input VC, and simultaneously moving all cells in said first packet queue in which cells corresponding to one packet are stored to a first output queue corresponding to route information described in said IP route table in correspondence with a destination IP address contained in a start cell, and a first output section for outputting a cell in said first output queue to a corresponding output buffer section through said cell switch section upon converting a VPI/VCI in the cell into a VPI/VCI of an output VC and the number of a self-input buffer section, and

each of said output buffer sections comprises second packet queues prepared to be equal in number to said input buffer

sections for the respective output VCs of said output buffer section, a second output queue for each output VC of said output buffer section, a second IP processing section for sequentially storing cells arriving from each input buffer section through said cell switch section in said second packet queue corresponding to an input buffer section number in each cell, and simultaneously moving all cells in said second packet queue in which cells corresponding to one packet are stored to said second output queue corresponding to the VPI/VCI of the output VC contained in each cell, and a second output section for outputting a cell in said second output queue to a corresponding output VC.

43. A node apparatus which comprises a plurality of input buffer sections, a plurality of output buffer sections, and a cell switch section for transferring a cell output from an arbitrary input buffer section to an arbitrary output buffer section, and performs switching for a packet segmented into cells according to AAL5 without packet reassembly,

characterized in that each of said input buffer sections comprises first output queues prepared by the number of output VCs of said node apparatus for each input VC of said input buffer section, an IP route table in which route information is written for each destination IP address, a first IP processing section for sequentially storing cells constituting an IP packet arriving from each input VC to said first output queue determined by route information in said IP route table which corresponds to a destination IP address contained in a start cell of the packet and said input VC, and a first output section

for outputting a cell in said first output queue to said corresponding output buffer section through said cell switch section upon converting a VPI/VCI in the cell into an internal identifier which can uniquely specify an output VC and input VC, and

each of said output buffer sections comprises second packet queues prepared by the number of input VCs of said node apparatus for each output VC of said output buffer section, a second output queue for each output VC of said output buffer section, a second IP processing section for sequentially storing cells arriving from each input buffer section through said cell switch section in said second packet queue corresponding to an internal identifier in each cell, and simultaneously moving all cells in said second packet queue in which cells corresponding one packet are stored to said second output queue corresponding to the internal identifier contained in each cell, and a second output section for outputting a cell in said second output queue to a corresponding output VC upon converting an internal identifier in the cell into an output VPI/VCI.

44. A node apparatus according to claim 41, characterized in that a CRC check on an AAL5 frame and a CRC re-calculation accompanying IP header updating are performed while the AAL5 frame is segmented into cells without packet reassembly.

45. A node apparatus according to claim 42, characterized in that a CRC check on an AAL5 frame and a CRC re-calculation accompanying IP header updating are performed while the AAL5 frame is segmented into cells without packet reassembly.

46. A node apparatus according to claim 43, characterized in

that a CRC check on an AAL5 frame and a CRC re-calculation accompanying IP header updating are performed while the AAL5 frame is segmented into cells without packet reassembly.

47. A node apparatus according to claim 44, characterized in that each of said input buffer sections comprises a VC table for storing an interim value for a CRC check on an AAL5 frame and an interim value for a CRC re-calculation, and said first IP processing section is configured to calculate, when a start cell of a packet arrives, a CRC value from the incoming cell, store an interim value in said VC table, re-calculate a CRC value from the start cell upon IP header updating, store an interim value in said VC table, calculate, when a cell other than the start cell of the packet arrives, a new CRC value from the incoming cell and the interim value for a CRC check, stored in said VC table, stores the interim value in said VC table, calculate a new CRC value from the incoming cell and the interim value for a CRC re-calculation, stored in said VC table, stores the interim value in said VC table, and write, after a CRC value is calculated from a final cell of the packet, a re-calculated CRC value in a CRC field of the final cell, and also check a CRC error in the AAL5 frame from a calculated value for a CRC check.

48. A node apparatus according to claim 45, characterized in that each of said input buffer sections comprises a VC table for storing an interim value for a CRC check on an AAL5 frame and an interim value for a CRC re-calculation, and said first IP processing section is configured to calculate, when a start cell of a packet arrives, a CRC value from the incoming cell, store an interim value in said VC table, re-calculate a CRC value from

the start cell upon IP header updating, store an interim value in said VC table, calculate, when a cell other than the start cell of the packet arrives, a new CRC value from the incoming cell and the interim value for a CRC check, stored in said VC table, stores the interim value in said VC table, calculate a new CRC value from the incoming cell and the interim value for a CRC re-calculation, stored in said VC table, stores the interim value in said VC table, and write, after a CRC value is calculated from a final cell of the packet, a re-calculated CRC value in a CRC field of the final cell, and also check a CRC error in the AAL5 frame from a calculated value for a CRC check.

49. A node apparatus according to claim 46, characterized in that each of said input buffer sections comprises a VC table for storing an interim value for a CRC check on an AAL5 frame and an interim value for a CRC re-calculation, said first IP processing section is configured to calculate, when a start cell of a packet arrives, a CRC value from the incoming cell, store an interim value in said VC table, re-calculate a CRC value from the start cell upon IP header updating, store an interim value in said VC table, calculate, when a cell other than the start cell of the packet arrives, a new CRC value from the incoming cell and the interim value for a CRC check, stored in said VC table, stores the interim value in said VC table, calculate a new CRC value from the incoming cell and the interim value for a CRC re-calculation, stored in said VC table, stores the interim value in said VC table, and write, after a CRC value is calculated from a final cell of the packet, a re-calculated CRC value in a CRC field of the final cell, and also check a CRC

error in the AAL5 frame from a calculated value for a CRC check.

50. A node apparatus according to claim 44, characterized in that each of said input buffer sections comprises a first VC table for storing an interim value for a CRC check on an AAL5 frame, said first IP processing section is configured to calculate, when a start cell of a packet arrives, a CRC value from the incoming cell, store the interim value in said first VC table, update an IP header, calculate, when a cell other than the start cell of the packet arrives, a new CRC value from the incoming cell and the interim value for a CRC check, stored in said first VC table, store the interim value in said first VC table, and check a CRC error in the AAL5 frame after a CRC value is calculated from a final cell of the packet, each of said output buffer sections comprises a second VC table for storing an interim value for a CRC re-calculation on an AAL5 frame, and said second IP processing section is configured to re-calculate, when a start cell of a packet arrives, a CRC value from the incoming cell, store the interim value in said second VC table, calculate, when a cell other than the start cell of the packet arrives, a new CRC value from the incoming cell and the interim value for a CRC re-calculation, stored in said second VC table, store the interim value in said second VC table, and write, after a CRC is calculated from a final cell of the packet, the re-calculated CRC value in a CRC field of the final cell.

51. A node apparatus according to claim 45, characterized in that each of said input buffer sections comprises a first VC table for storing an interim value for a CRC check on an AAL5 frame, said first IP processing section is configured to

calculate, when a start cell of a packet arrives, a CRC value from the incoming cell, store the interim value in said first VC table, update an IP header, calculate, when a cell other than the start cell of the packet arrives, a new CRC value from the incoming cell and the interim value for a CRC check, stored in said first VC table, store the interim value in said first VC table, and check a CRC error in the AAL5 frame after a CRC value is calculated from a final cell of the packet, each of said output buffer sections comprises a second VC table for storing an interim value for a CRC re-calculation on an AAL5 frame, and said second IP processing section is configured to re-calculate, when a start cell of a packet arrives, a CRC value from the incoming cell, store the interim value in said second VC table, calculate, when a cell other than the start cell of the packet arrives, a new CRC value from the incoming cell and the interim value for a CRC re-calculation, stored in said second VC table, store the interim value in said second VC table, and write, after a CRC is calculated from a final cell of the packet, the re-calculated CRC value in a CRC field of the final cell.

52. A node apparatus according to claim 46, characterized in that each of said input buffer sections comprises a first VC table for storing an interim value for a CRC check on an AAL5 frame, said first IP processing section is configured to calculate, when a start cell of a packet arrives, a CRC value from the incoming cell, store the interim value in said first VC table, update an IP header, calculate, when a cell other than the start cell of the packet arrives, a new CRC value from the incoming cell and the interim value for a CRC check, stored in

said first VC table, store the interim value in said first VC table, and check a CRC error in the AAL5 frame after a CRC value is calculated from a final cell of the packet, each of said output buffer sections comprises a second VC table for storing an interim value for a CRC re-calculation on an AAL5 frame, and said second IP processing section is configured to re-calculate, when a start cell of a packet arrives, a CRC value from the incoming cell, store the interim value in said second VC table, calculate, when a cell other than the start cell of the packet arrives, a new CRC value from the incoming cell and the interim value for a CRC re-calculation, stored in said second VC table, store the interim value in said second VC table, and write, after a CRC is calculated from a final cell of the packet, the re-calculated CRC value in a CRC field of the final cell.

53. A node apparatus according to claim 42, characterized in that not only a cell of a packet but also a general ATM cell are processed.

54. A node apparatus according to claim 43, characterized in that not only a cell of a packet but also a general ATM cell are processed.

55. A node apparatus according to claim 44, characterized in that not only a cell of a packet but also a general ATM cell are processed.

56. A node apparatus according to claim 53, characterized in that each of said input buffer sections comprises a first VC table containing an IP identification flag for designating each input VC as an input VC set for ATM or IP and an output destination queue for designating an output queue when an input

VC is set for ATM, and a header processing section for storing, at the time of arrival of a cell, the cell which has arrived through an input VC set for ATM in a first output queue designated by the output destination queue in said first VC table in correspondence with the input VC through which the cell has arrived, and transferring the cell which has arrived through an input VC set for IP to said first IP processing section, and

each of said output buffer sections comprises a second VC table containing an IP identification flag for designating each internal identifier or each pair of an output VPI/VCI and an input buffer section number as an internal identifier or a pair of an output VPI/VCI and an input buffer number set for ATM or IP and an output destination queue for designating an output queue when each internal identifier or each pair of an output VPI/VCI and an input buffer section number is set for ATM, and a first header processing section for storing, at the time of arrival of a cell, an ATM cell in said second output queue designated by the output destination queue in said second VC table, and transferring an IP cell to said second IP processing section.

57. A node apparatus according to claim 54, characterized in that each of said input buffer sections comprises a first VC table containing an IP identification flag for designating each input VC as an input VC set for ATM or IP and an output destination queue for designating an output queue when an input VC is set for ATM, and a header processing section for storing, at the time of arrival of a cell, the cell which has arrived through an input VC set for ATM in a first output queue

designated by the output destination queue in said first VC table in correspondence with the input VC through which the cell has arrived, and transferring the cell which has arrived through an input VC set for IP to said first IP processing section, and

each of said output buffer sections comprises a second VC table containing an IP identification flag for designating each internal identifier or each pair of an output VPI/VCI and an input buffer section number as an internal identifier or a pair of an output VPI/VCI and an input buffer number set for ATM or IP and an output destination queue for designating an output queue when each internal identifier or each pair of an output VPI/VCI and an input buffer section number is set for ATM, and a first header processing section for storing, at the time of arrival of a cell, an ATM cell in said second output queue designated by the output destination queue in said second VC table, and transferring an IP cell to said second IP processing section.

58. A node apparatus according to claim 55, characterized in that each of said input buffer sections comprises a first VC table containing an IP identification flag for designating each input VC as an input VC set for ATM or IP and an output destination queue for designating an output queue when an input VC is set for ATM, and a header processing section for storing, at the time of arrival of a cell, the cell which has arrived through an input VC set for ATM in a first output queue designated by the output destination queue in said first VC table in correspondence with the input VC through which the cell has arrived, and transferring the cell which has arrived through

an input VC set for IP to said first IP processing section, and

each of said output buffer sections comprises a second VC table containing an IP identification flag for designating each internal identifier or each pair of an output VPI/VCI and an input buffer section number as an internal identifier or a pair of an output VPI/VCI and an input buffer number set for ATM or IP and an output destination queue for designating an output queue when each internal identifier or each pair of an output VPI/VCI and an input buffer section number is set for ATM, and a first header processing section for storing, at the time of arrival of a cell, an ATM cell in said second output queue designated by the output destination queue in said second VC table, and transferring an IP cell to said second IP processing section.

59. A node apparatus according to claim 53, characterized in that when an incoming packet is a multicast packet, said second IP processing section implements an IP multicast function by using a cell multicast function of an ATM switch instead of copying the packet.

60. A node apparatus according to claim 54, characterized in that when an incoming packet is a multicast packet, said second IP processing section implements an IP multicast function by using a cell multicast function of an ATM switch instead of copying the packet.

61. A node apparatus according to claim 55, characterized in that when an incoming packet is a multicast packet, said second IP processing section implements an IP multicast function by using a cell multicast function of an ATM switch instead of

copying the packet.

62. A node apparatus according to claim 41, characterized in that said node apparatus comprises an IP server section having necessary functions as an IP router, e.g., a function of processing a routing packet and a function of processing a packet with an IP option, and a function of managing said IP route table, and when an incoming packet cannot be processed by said first IP processing section of each input buffer section, transfers the packet to said IP server section to make said IP server section process the packet and update said IP route table if required as a result of processing.

63. A node apparatus according to claim 42, characterized in that said node apparatus comprises an IP server section having necessary functions as an IP router, e.g., a function of processing a routing packet and a function of processing a packet with an IP option, and a function of managing said IP route table, and when an incoming packet cannot be processed by said first IP processing section of each input buffer section, transfers the packet to said IP server section to make said IP server section process the packet and update said IP route table if required as a result of processing.

64. A node apparatus according to claim 43, characterized in that said node apparatus comprises an IP server section having necessary functions as an IP router, e.g., a function of processing a routing packet and a function of processing a packet with an IP option, and a function of managing said IP route table, and when an incoming packet cannot be processed by said first IP processing section of each input buffer section,

transfers the packet to said IP server section to make said IP server section process the packet and update said IP route table if required as a result of processing.

65. A node apparatus according to claim 62, characterized in that said IP route table holds a substantially perfect copy of part of an IP route table held in said IP server section, and when a route search with respect to a given packet fails in said first IP processing section of each input buffer section, the packet is transferred to said IP server section to make said IP server section process the packet and update said IP route table which has failed the route search.

66. A node apparatus according to claim 63, characterized in that said IP route table holds a substantially perfect copy of part of an IP route table held in said IP server section, and when a route search with respect to a given packet fails in said first IP processing section of each input buffer section, the packet is transferred to said IP server section to make said IP server section process the packet and update said IP route table which has failed the route search.

67. A node apparatus according to claim 64, characterized in that said IP route table holds a substantially perfect copy of part of an IP route table held in said IP server section, and when a route search with respect to a given packet fails in said first IP processing section of each input buffer section, the packet is transferred to said IP server section to make said IP server section process the packet and update said IP route table which has failed the route search.

68. A node apparatus according to claim 62, characterized in

that said IP route table holds a substantially perfect copy of part of an IP route table held in said IP server section, and when a route search with respect to a given packet fails in said first IP processing section of each input buffer section, said IP server section is requested to perform a route search with respect to the packet, said IP server section performs a route search in accordance with the request and notifies said first IP processing section of the result, and said first IP processing section processes the packet in accordance with the route search result.

69. A node apparatus according to claim 63, characterized in that said IP route table holds a substantially perfect copy of part of an IP route table held in said IP server section, and when a route search with respect to a given packet fails in said first IP processing section of each input buffer section, said IP server section is requested to perform a route search with respect to the packet, said IP server section performs a route search in accordance with the request and notifies said first IP processing section of the result, and said first IP processing section processes the packet in accordance with the route search result.

70. A node apparatus according to claim 64, characterized in that said IP route table holds a substantially perfect copy of part of an IP route table held in said IP server section, and when a route search with respect to a given packet fails in said first IP processing section of each input buffer section, said IP server section is requested to perform a route search with respect to the packet, said IP server section performs a route

search in accordance with the request and notifies said first IP processing section of the result, and said first IP processing section processes the packet in accordance with the route search result.

71. A node apparatus according to claim 41, characterized in that different VCs are set between said node apparatus and another node apparatus in units of virtual dedicated networks, route information for each virtual dedicated network is defined in said IP route table, each input buffer section specifies a virtual dedicated network from an input VC through which a cell has arrived, and obtains route information of the packet by searching said IP route table by using the specified virtual dedicated network and a destination IP address.

72. A node apparatus according to claim 42, characterized in that different VCs are set between said node apparatus and another node apparatus in units of virtual dedicated networks, route information for each virtual dedicated network is defined in said IP route table, each input buffer section specifies a virtual dedicated network from an input VC through which a cell has arrived, and obtains route information of the packet by searching said IP route table by using the specified virtual dedicated network and a destination IP address.

73. A node apparatus according to claim 43, characterized in that different VCs are set between said node apparatus and another node apparatus in units of virtual dedicated networks, route information for each virtual dedicated network is defined in said IP route table, each input buffer section specifies a virtual dedicated network from an input VC through which a cell

has arrived, and obtains route information of the packet by searching said IP route table by using the specified virtual dedicated network and a destination IP address.

74. A node apparatus according to claim 41, characterized in that said node apparatus has different IP addresses in units of virtual dedicated networks, and generates IP route information by executing different IP routing protocols in units of virtual dedicated networks.

75. A node apparatus according to claim 42, characterized in that said node apparatus has different IP addresses in units of virtual dedicated networks, and generates IP route information by executing different IP routing protocols in units of virtual dedicated networks.

76. A node apparatus according to claim 43, characterized in that said node apparatus has different IP addresses in units of virtual dedicated networks, and generates IP route information by executing different IP routing protocols in units of virtual dedicated networks.